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Breast milk sodium

W W K KOO AND J M GUPTA

Royal Hospital for Women, Paddington, New South Wales, and Prince of Wales Children's Hospital, Randwick, New South Wales, Australia

SUMMARY Sodium content was analysed from 360 breast milk samples of 45 mothers who delivered at term and from 206 samples of 22 mothers who delivered preterm in the first 4 weeks postpartum. The sodium content was consistently higher in the milk from mothers of preterm infants. In both groups, the sodium content of the breast milk decreased rapidly for the first 3 days, and then more slowly. After the first week, the daily variation of sodium concentration in the breast milk was minimal. There was no significant statistical difference in the sodium content of breast milk before compared with after feeding nor was there any difference in sodium content from either breast.

It is generally accepted that breast feeding has many advantages for mother and infant.[1] However, there has recently been doubt about whether human milk is the best food for babies of low birthweight in view of the fact that such infants are at risk of developing deficiencies of specific nutrients.[2 3] It has been shown that owing to the increased urinary sodium loss,[4] the preterm infant who is fed on pooled breast milk or 'humanised' cows' milk formula is at risk of developing hyponatraemia. Higher sodium intake than that present in breast milk has therefore been recommended for very low birthweight infants.[4] This study was undertaken to determine whether the sodium content of breast milk produced by mothers delivering preterm infants was different from that produced by mothers delivering term babies, and to investigate the postnatal changes in sodium content of breast milk from both groups of mothers.

Materials and methods

The subjects of this study were 45 mothers who delivered their infants between 37 and 41 weeks' gestation (group A) and 22 mothers who delivered their infants between 27 and 34 weeks' gestation (group B). This study was conducted from birth to 28 days' postpartum. About 2 ml of breast milk was obtained at the beginning or the end of feeding, or at both times, by manual expression during the first 24 hours after delivery, and thereafter at similar times from the same breast each morning. Three hundred and sixty breast milk samples were obtained from group A and 206 breast milk samples from group B. The milk samples comprised:

(1) One hundred and twenty paired (before and after feeding) samples from group A, and 31 similarly paired samples from group B.

(2) Twelve pairs of milk samples from each breast of 3 mothers who delivered infants at 34, 38, and 41 weeks' gestation between 3 and 26 days postpartum.

(3) Thirteen sets of milk samples collected during 3 consecutive 8-hour periods (period 1, 0401–1200 hours; period 2, 1201–2000 hours; period 3, 2001–0400 hours) from 10 mothers (4 from group A and 6 from group B) between 4 and 21 days postpartum.

(4) Eighty-five single samples from group A and 116 single samples from group B between 1 and 28 days postpartum.

All mothers were healthy and not taking diuretics while breast feeding. The samples were stored in electrolyte-free, tightly sealed polypropylene containers and frozen at −20°C. Before analysis, the samples were allowed to thaw at room temperature and were assayed by flame photometer* after vigorous shaking of the contents. The coefficient of variation of the assay was less than 1%.

Paired *t* tests were carried out comparing the difference in sodium content of milk before and after feeding, between the milk from left and right breasts, and between milk samples obtained at different times of the day. Log transformation was used and then the analysis of variance was carried out to compare the sodium content between the group A and group B samples, the changes in sodium content with respect to the time after delivery, and the interaction between the gestational period and the postpartum

*IL343 flame photometer, Instrumentation laboratory, Mass, USA.

Table *Postpartum changes in breast milk sodium* from mothers delivering preterm and at term*

Breast milk sodium (mmol/l)	*Days postpartum*								
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8–14*	*15–28*
Preterm									
n	5	8	8	9	5	9	9	52	52
Mean	70·9	54·1	21·8	28·3	15·6	18·9	17·3	13·1	10·6
1 SEM	11·4	8·7	3·1	4·7	2·8	4·0	2·3	0·6	0·6
Term									
n	17	21	18	17	19	15	12	53	48
Mean	64·8	43·7	21·4	16·6	16·2	15·7	14·8	9·8	6·9
1 SEM	4·4	5·1	2·3	1·7	1·6	1·8	2·6	0·6	0·2

*Statistical analysis—see text.
Conversion: SI to traditional units—1 mmol/l ≈ 23 mg/l.

period. The exponential regression curve for the sodium content as a function of postnatal age was fitted to the breast milk samples from group A and group B.

Results

The sodium content of the breast milk was highest immediately after delivery in both groups (64·8±4·4 mmol/l* in group A and 70·9±11·4 mmol/l* in group B). These levels fell precipitously by day 3. After the first week postpartum, the mean breast milk sodium content remained fairly stable throughout the day. There was however, a gradual fall in the breast milk sodium level thereafter throughout the period of study (Table). The fluctuation in breast milk sodium concentration in both groups diminished as the supply of mature breast milk became established (Figure).

*Mean ± SEM.

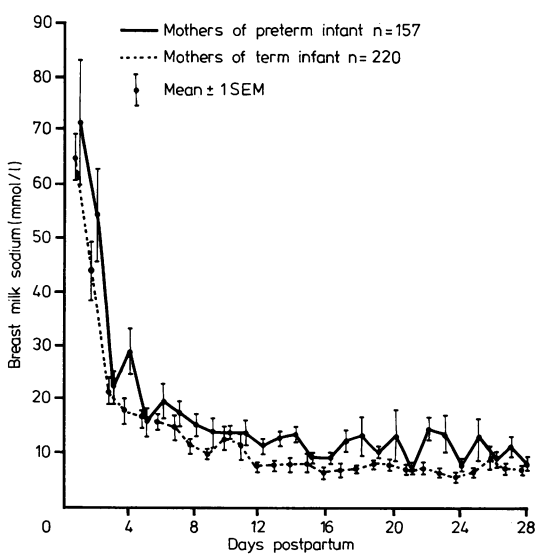

Figure *Postpartum changes in breast milk sodium.*

Analysis of variance of the data showed that there was a highly significant difference ($P<0·001$) between the sodium content of the breast milk from group A and that from group B. The mean sodium concentration of the breast milk in group B was on average about 3 mmol/l greater than that in group A according to the exponential regression curve of best fit for the mean breast milk sodium of group B samples which was $y=11·93+100·09e^{-0·51x}$ and that for group A samples which was $y=8·92+101·76e^{-0·59x}$, where y = breast milk sodium content and x = days postpartum. There was also a highly significant difference ($P<0·001$) in breast milk sodium in each group between the various days postpartum.

There was no statistical difference in the sodium content of breast milk obtained before and after feeding ($P=0·46$ for group A and $P=0·17$ for group B); that obtained from the left and right breasts ($P=0·12$); and that obtained at different times of the day ($P=0·27$ for periods 1 compared with 2, $P=0·48$ for periods 1 compared with 3, and $P=0·20$ for periods 2 compared with 3).

Discussion

Previous studies on the sodium content of breast milk from mothers delivered of preterm infants compared with breast milk from mothers who delivered term infants have shown contradictory results. Aperia *et al.*[5] reported lower values from mothers of preterm infants, Gross *et al.*[6] reported higher values, and Atkinson *et al.*[7] suggested that there was no difference. These conflicting results might have been due to sample size, time of sampling, or method of presenting the data. Aperia *et al.*[5] drew their conclusions after examining 19 samples of breast milk from mothers of preterm infants over a period of 11 days but did not state the number of mothers who took part. By sampling on selected days

postpartum,[6] or by pooling of data from samples obtained over several days,[7] the high sodium content of early breast milk may become less evident. Despite differences in collection techniques (that is, from a complete 24-hour collection,[7] from emptying both breasts on one occasion,[6] or from the beginning or at the end of a feed[5]), or sample preparation and assay—these studies support our study which shows a significantly higher sodium content in early breast milk.

Our results show there are progressive changes in the sodium content of breast milk in the postpartum period from both groups of mothers. The high sodium content in the first few days in both groups suggests that the sodium requirement of preterm infants may best be met by using pooled expressed milk from donor mothers during the early postpartum period. Furthermore, the consistently higher sodium content of the breast milk from mothers of preterm babies throughout the neonatal period suggests it is better adapted to meet the increased requirement of the preterm babies.

Although there may be differences in various components of breast milk at the beginning and the end of a feed,[8] our results show this is not the case with respect to sodium content of the breast milk in the absence of unusual dietary habits or systemic or local disease processes affecting the breast. Furthermore, after the first few days of lactation, the breast milk sodium does not seem to show a significant diurnal change and does not appear to differ between either breast.

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Correspondence to Dr W Koo, University of Cincinnati Medical Center, Pediatrics: Newborn Division, 231 Bethesda Avenue, Cincinnati, Ohio 45267, USA.

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